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APPALACHIAN FOREST EXPERIMENT STATION

ANNUAL REPORT

FOR

CALENDAR YEAR 1945

UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE
Southeastern
APPALACHIAN FOREST EXPERIMENT STATION



ADDRESS REPLY TO
DIRECTOR
AND REFER TO

FEDERAL BUILDING,
ASHEVILLE, N. C.

R-SE
REPORTS
Station's Annual

November 15, 1946

Assistant Chief, Forest Service
In Charge Forest Research
Washington 25, D. C.

Dear Mr. Kotok:

In accordance with standing instructions and Larrimer's request of June 26, 1946, three copies of this letter are submitted as our annual report for the calendar year 1945. As during the war years, no attempt will be made to present a full and detailed account of Station accomplishments, activities and plans. This is because various events, including my own five and one-half months' absence at the beginning of the year, have delayed preparation of a full report until we have had a full year of peacetime activity.

It is regretted that this short report comes too late to be of use to you in preparing for Departmental and Budget hearings.

1945 IN REVIEW

Though our major wartime job of continuously appraising lumber stocks continued unabated, conversion to a peacetime basis was begun even before the close of hostilities. Important new work was started in naval stores and in the establishment of the first forest utilization services at two eastern stations. Such conversion was accelerated in 1945 with the appropriation of \$300,000 to reactivate and expand experimental forest centers throughout the South and Southeast, plus additional funds for utilization services. These funds not only permitted the establishment of a small utilization unit at the Appalachian Station and restoration of forest management work materially curtailed for the war period, but also provided for expansion of the Station's forest management studies into the important pine and pine hardwood types of the coastal plain. This major physiographic region contains some

33 percent of the forest acreage and about 36 percent of the forest production possibilities of the Appalachian Station territory. The expansion marked a real milestone in station history, the first time in its quarter century of existence that any substantial program in the coastal plain could be undertaken.

There were two other aspects of this expansion well worth noting. One was Congressional willingness to look ahead and appropriate for restoration and expansion of peacetime activities before peace was assured. Even more satisfactory, from our viewpoint, was the fact that the drive for the establishment and activation of an adequate number of work centers came from forest landowners, spearheaded by the Forest Farmers Association Cooperative of Valdosta, Georgia, whose leaders are familiar with work at such established forest research centers as the Olustee and Crossett Experimental Forests of the Southern Station. These men had become convinced that public expenditures for forest research returned tangible dividends to forest landowners and industries, and that a major aid to forest landowners in the South would result from substantial expansion of such activities. In this they were joined by state forestry organizations, state foresters, farm and conservation organizations, and many individual owners.

This enlightened opinion reflected in some degree a rising tide of interest on the part of southern forest landowners and industrialists in the possibilities of growing timber as a crop. The war had thrown into bold relief, in this region, as everywhere, the importance of abundant, almost inexhaustible natural resources as a basis for national survival; had created an insatiable demand for both primary and secondary forest products, such as lumber and paper; and had demonstrated the lack of really adequate supplies of high quality materials, such as airplane veneers, oak ship timbers, and hickory tool handles, as well as the need for a great bulk supply of timber for crating, cardboard, and other less exacting products. The critical nature of the supply in the face of war needs aroused even the long complacent and inert, though once militant and powerful, American Forestry Association to take a new look at the forest situation. Similarly, many individual owners and industries were awakened to the necessity of protecting their raw material supply, or were interested in the possibilities of returns from timber growing, as well as from products manufacture. As might be expected, not all segments of the industry seemed equally alert. In the Carolinas, for example, in the face of rising prices, longer freight hauls, lowered quality and obvious scarcities, the great furniture industry, with some notable exceptions, seemed remarkably complacent about its raw material supply. But even here some companies were alert to the resource situation and its possibilities, and most pulp companies and many lumber companies showed tangible evidence of their interest by purchasing forest land and organizing or expanding forestry departments.

As you know, Research itself has gained popular appeal as a result of the war. Not only have spectacular developments such as radar and the atom bomb impressed a usually indifferent or semicontemptuous public of the value of research in such theoretical fields as nuclear physics, but on a much more mundane and familiar plane the activities of such organizations as our own Forest Products Laboratory have been impressive through their tangible assistance in solving numerous problems. For example, F. P. L.'s achievements in the field of packing and crating for the transport of great quantities of material required in the first truly global war and in the development of new materials and devices from wood ranging from plastic antenna posts to laminated ship keels are widely known. It would seem clear to any unbiased and thoughtful observer that such contributions, even under the great stimulus of war, could have been made in the quantity and with the degree of effectiveness obtained only by drawing on a reservoir of knowledge and skill accumulated during years of peacetime research. All of these things have brought about a growing appreciation of research and growing interest in the scope and progress of existing research efforts. As a result, the prospects for forest research on an adequate scale now seem brighter than they have been in over a decade.

The year was marked in the Appalachian region by a number of other events and programs of interest to this Station. One was the substantial expansion of fire control programs. Expenditures in six Appalachian states (Kentucky, Virginia, West Virginia, North Carolina, South Carolina and Tennessee) increased more than \$450,000 between 1944 and 1945 alone. It is worth a passing note that this great expansion in funds for fire control was accompanied by no expansion whatsoever in funds for research in the fire protection field, except for some small and temporary expenditures to finance studies in fire economics.

In addition, other agencies showed an encouraging growth of interest in forest research and resource use. Prominent were the grants made by the General Education Board for forest research at the University of Kentucky (the so-called Kentucky Highlands study in which this Station cooperated) and at the Duke School of Forestry. This agency is also supporting in part the activities of the Committee on Southern Regional Studies on Education, which is devoted to forwarding better resource use by proper channelling of informational and technical advances, including research results, into educational fields.

Along somewhat similar lines have been rather widespread State activities in resource use and industrial development. One prominent activity has been the Southwide, all-resource study of the Southern Association of Science and Industry under the leadership of Dr. Gordon W. Blackwell, Director of the Institute for Research in Social Science of the University of North Carolina. The Station is preparing a factual report on the forest resource and will

cooperate in the preparation of a chapter or unit monograph dealing with the resource situation and a recommended forest policy. Another somewhat similar activity in North Carolina, but also taking place in one form or another in almost all of the Appalachian States, was the formulation by Governor Cherry of a State Committee for the Promotion of Rural Industries. The opportunity for the promotion of forest industries of this character is obvious and the Station has already cooperated effectively toward this end with the North Carolina Department of Conservation and Development. Similar opportunities elsewhere await only time and proper leadership. One other event of interest in the Station's territory, though without direct tie to research activities, was the completion in North Carolina of a study by the Society of American Foresters on the subject of the state forestry organization. Though the report is conservative, it lays the basis for desirable action in building the state organization to the size and character warranted by its responsibilities. Similar state studies were made in Kentucky and West Virginia.

The same trend toward resource use and industrial development is noticeable in the wood-using industries. An example is the \$50,000 fund set up by the Southern Furniture Manufacturers Association for needed research in the manufacture of furniture.

One adverse factor in the face of these favorable signs has been a growing shortage of competent technical manpower in spite of the welcome return of experienced men from military service. All public as well as private organizations engaged in forestry or the use of forest products are experiencing increasing difficulty in finding competent technicians. The Southern Furniture Manufacturers Association has taken a realistic approach to the problem and has appointed a committee to negotiate with southern schools for the purpose of establishing a four-year college curriculum designed to train men for its industry.

The shortage of technical men is keenly felt by research agencies. The Bush report ^{1/} cites a deficit of 150,000 science and technology graduates for 1945 and predicts a deficit of adequately trained graduate students in the sciences, including biology, of about 17,000 by 1955. The technical man-power shortage has been a major factor at this Station in retarding the organization and operation of its investigative work at reactivated and newly established research centers; also in the continuation of war activities such as the monthly estimates of lumber stocks and production. Although

^{1/} Science the Endless Frontier. Report to the President on a Program for Postwar Scientific Research by Vannevar Bush, Director of O.S.R.D. 184 pp., Washington, 1945.

an adequate organization has now been obtained, on-the-job training in research technics and continued encouragement of graduate work on the part of promising investigators will be essential to round out an entirely satisfactory research staff. This is not a new problem in forest research.

STATION ACTIVITIES

Accomplishments for 1945

Although the war period was characterized by wide-scale conversion to war projects, the great bulk of normal activity being on a strictly maintenance basis, past informal reports have shown the satisfactory and productive fashion in which the Station continued to operate. In some cases, notably in Forest Influences and Forest Survey, our reduced staff maintained essential field activities only with the greatest difficulty and at considerable personal sacrifice. Nevertheless, the period was a very productive one as far as the completion of studies and manuscript preparation were concerned. Indeed, the very fact that all normal studies were on a strictly maintenance basis with field work at a minimum, proved a stimulant to progress or termination reports on a large number of studies. In 1942, for example, the Station issued 21 printed and some 10 processed papers and special reports; in 1943, 18 printed and 7 processed papers and reports; and in 1944, some 36 printed and 27 processed papers and reports. In each year from 3 to 5 of the printed reports were bulletins, circulars, or longer articles embodying a major contribution to forest science. Although 1945, as has been stated, was primarily a year of transition, with considerable effort being expended on the organization of new work and the reactivation of old, the Station put out during the year some 24 publications and 5 processed papers and reports. This was in spite of the fact that many earlier studies had already been completed during the war years and their results published, following which the pressure of wartime maintenance made immediate commencement of new studies impossible. In addition, the Station spent considerable effort in the preparation of statistical information for the nation-wide reappraisal project.

Forest Management

The organization of new work fell most heavily upon the Division of Forest Management charged with the staffing and organization of two completely new experimental centers in the coastal plain (one involving the selection and complete organization of a new experimental forest) and the reactivation of a major program of upland

hardwood research. In addition, one new area in the northern piedmont of Virginia, the center for a substantial program of planting research, was reactivated for forest management on a small scale. The new program involved not only the selection of men and areas, but almost complete revamping of research emphasis in the forest management field. In the past, investigations in the field of forest management have been almost entirely on a small sample plot basis, much of the work being confined to the hardwood types of the Appalachian mountains. This work has been productive, and together with the information accumulating from experience and administrative studies has furnished a fairly satisfactory basis upon which to draw up rules of practice sufficient for crude forest management. It seemed that the time had now come for testing this knowledge by pilot plant operations, namely, through commercial-sized cuttings in which not only silvicultural knowledge could be put to the test, but in which additional knowledge could be obtained on cost and returns on a commercial scale. Obviously, any such group of cuttings, particularly when directed at more intensive forest management practices, would indicate where knowledge is still inadequate, and should be accompanied by a group of sample plot or project studies if such studies offer the most efficient way of filling these gaps. This entire approach is felt to be timely and more practical in its direction than continuation of past programs in full.

As stated, four such experimental programs have been established during the past year. Delays in recruiting, partly due to the desirability of waiting for the return of men from military service, and the large amount of work required to organize an experimental forest and establish the controls in type maps, volume, and quality inventory, etc. necessary for good research work, delayed beyond the end of the calendar year the completion of work productive of immediate results.

Other aspects of management, however, continued to make definite progress. A final report on methods of predicting growth of uneven aged stands on the basis of diameter distribution was completed and submitted for publication. If this method is applicable under other conditions, it offers a major contribution to the problem of predicting growth in uneven aged stands, one of the most costly and difficult of forest management problems.

Eight years of intensive fire detection research were completed with a final report for publication on the theory and application of visibility measurement. Also, a major technical paper was completed explaining, on the basis of the quantum nature of light, the factors that control visibility thresholds and other phenomena. This publication makes an important contribution to the physics of visibility on a broad scale as well as to those aspects applicable to better forest fire detection.

The planting research program of the Station continued to produce useful results. One of the most important steps forward was made in the field of direct seeding by both hand and machine methods. Intensive direct seeding pilot plant tests, following up 2 early, less intensive studies, showed that machine methods resulted in adequate stocking at costs of about one-half those of orthodox planting.

During the past year the Station also prepared a comprehensive report for publication summing up what we have learned on how to choose the right species for the right site when planting old fields in the mountain and inter-valley region. These results furnish a practical method of deciding from observable field conditions such as character of soil, aspect, physiographic location, etc., just what species offer the best chance for success, and what combination of species will be suitable. These results are now being put to practical use by Extension Foresters and others in guiding private and national forest planting in the mountain section.

The Station also completed during the past year a study on how to grow better spruce planting stock, one of the difficult problems which has faced West Virginia forest administrators in the planting field in past years. Our work showed that the application of compost-high nitrogen fertilizer to nursery seedbeds produces better stock, although the differences are disappointingly small.

Studies of early response to weeding in hardwood stands show that "growth energy," as expressed by a degree of tolerance, dominance, and vigor, determines the profitability of releasing young trees. The Station's work also shows clearly that pruning up to 35 percent of the live whorls of white pine has significant effect on growth rate. In general, the Station is now in a good position to sum up for practical use the results of several decades' work in weeding improvement and thinning studies. A comprehensive bulletin on this topic scheduled for completion this year was not written because of the pressure under which the small Management staff was working to organize and develop new experimental work programs. It seems probable that the preparation of this bulletin will be delayed for at least another year.

Forest Fire Economics

The forest fire economics project, begun last year to determine how much money can be justifiably spent for forest protection in view of all of the values at stake in a given area, and how we can assure that each dollar expended returns at least an equivalent amount in reduced losses, has also been productive. The first of the case studies in this field in the Virginia piedmont indicates that the present expenditure of 2 cents per acre is just half the

most effective amount. If 4 cents per acre were spent on protection, area burned would be cut from 0.6 percent to 0.3 percent, and damage per acre protected reduced from 8 cents to 4 cents. A similar study in the southwest Virginia mountain region is now under way.

Forest Economics

The bulk of the reappraisal effort fell on a relatively small Forest Survey unit already burdened with the supervision of a War Production Board program continued in full force during the reconversion and early postwar period. Reappraisal tables were prepared for South Carolina, North Carolina, Virginia, West Virginia, and Tennessee showing forest area by ownership and stocking class; timber volumes by species, ownership, and stocking class; current annual growth; and current commodity drains. The result was an up-to-date estimate of the timber situation in those states. In addition, field checks were made to determine logging and manufacturing waste, and tables were prepared showing for each state the total amount, amount used, and amount wasted.

Growth: As a part of the Reappraisal mentioned above, board-foot and cubic-foot growth during 1944 were computed for all survey units in the Carolinas and Virginia, and for the States of West Virginia and Tennessee. For the first three states these growth figures are considered preliminary, and will be revised slightly before being used to bring Forest Survey figures up to date.

Drain: Through our cooperative activities with the War Production Board and the Bureau of the Census we were able to prepare reliable estimates of lumber, pulpwood, and veneer drain in 1944. Timber consumed for fuelwood and miscellaneous products was estimated, based on trends from previous years, with the result that we now have reasonably accurate estimates of the amount of timber cut in 1944 from the forests of the Carolinas, Virginia, West Virginia, and Tennessee. In this connection, it is interesting to note that nearly 2.5 million cords of pulpwood, excluding chestnut, were cut in the five states in 1944 and that pulpwood now accounts for 10 percent of the total drain on sound trees 5.0 inches d.b.h. and larger. In South Carolina 25 percent of the softwood drain is for pulpwood, and the proportion is gradually but constantly increasing.

1944 pulpwood drain by states.

State	Softwood M cords	Hardwood M cords	Total M cords	Proportion of total drain		
				Sftd. Percent	Hwd. Percent	Total Percent
South Carolina	920	41	961	25	3	20
North Carolina	445	75	520	8	3	6
Virginia	667	162	829	18	8	14
West Virginia	30	46	76	12	2	3
Tennessee	27	35	62	2	1	1
	2,089	359	2,448	14	3	10

Resource Analyses: Due to the keen interest in the effect of war cutting, the forest growth and drain data, which had been carried forward through 1943 from the date of the original forest survey in each state, was summarized, and reports were prepared for North Carolina and South Carolina entitled:

Release No. 18 - "North Carolina Forest Growth and Drain, 1937-1943." January 31, 1945.

Release No. 20 - "South Carolina Forest Growth and Drain, 1936-1943." June 1, 1945.

Basic tables were also prepared for Virginia, but since only a four-year period was covered, a report was not prepared. In brief, these reports and analyses showed that during the period 1940 to

January 1, 1944, the drain was generally in excess of growth in the saw-timber stands, although not as great as was expected. Both pine and hardwood stands decreased in volume by a small percent, except hardwood saw timber in Virginia.

Changes in saw-timber growing stock, January 1, 1940-January 1, 1944

State	(Million board feet)					
	Pine			Hardwood		
	1940	1944	% Change	1940	1944	% Change
South Carolina	19,127	18,398	-3.8	11,670	11,312	-3.1
North Carolina	27,407	26,787	-2.3	15,615	15,502	-0.7
Virginia	12,266	11,942	-2.6	11,930	13,087	+9.7
Total	58,800	57,127	-2.8	39,215	39,901	+1.8

Ever since the start of the Forest Survey in this region there has been a demand for forest area and volume figures by county. Pulp companies, railroads, chambers of commerce, planning commissions, and other groups constantly asked for such information. In April 1945, Forest Survey Release No. 19, "Approximate Forest Area and Timber Volume by County in the Carolinas and Virginia," was issued. Largely statistical, it also contained a brief precautionary statement relative to the limitations of the data by individual counties. To date it has been one of our "best sellers."

In addition, assistance was given the Resource Appraisal of the American Forestry Association by furnishing volume tables, converting factors, and growth and drain estimates. As an example of direct aid to industry, we prepared a special report for the West Virginia Pulp and Paper Co. on the pulpwood situation in South Carolina, and answered nearly 500 requests for Survey reports, volume tables, and information on wood supplies in specific areas.

Progress was continued on the Virginia State Report which the Station had promised for publication this year. This promise could not be kept.

Requirements, Production, and Supplies

With the end of the war in the Pacific it was at first believed that the need for statistics on lumber production, reports on factors affecting lumber production, and special reports on various phases of the forest products industries would soon end. However, when the War Production Board was replaced by the Civilian Production Administration, we were asked to continue our cooperative

work, and before the end of the year it became apparent that the need for such information was highly essential in organizing for reconversion. Subsequently, the acute housing shortage and declining lumber production have added fresh emphasis to the need for such service. During 1945 our work has centered on the following projects:

Monthly Lumber Production: Each month reports were obtained by mail and field contacts from approximately 650 sample mills distributed throughout all size classes of mills, each state, and each OPA price region. With these mills as samples, an estimate of total lumber production, by species, was prepared for each state and OPA price region. A summary of the monthly estimates for 1945 shows that 1945 production, totalling 4.8 billion board feet in our six states, was 12 percent below 1944, and 18 percent below 1943. This decline in production is a major factor retarding the expansion of the housing program, as it is typical of the national production trend.

Estimated lumber production by months, 1945.

Month	(Million board feet)					
	South Carolina	North Carolina	Virginia	West Virginia	Kentucky	Tennessee
January	69	121	78	25	19	38
February	65	107	74	27	23	46
March	80	155	108	49	35	51
April	74	133	94	45	39	56
May	78	145	96	39	41	60
June	71	130	86	44	40	60
July	61	102	78	47	45	71
August	66	113	88	48	47	65
September	45	99	75	45	42	65
October	72	128	91	47	40	68
November	78	131	85	41	33	56
December	52	58	37	22	12	23
Total	811	1,422	990	479	416	659

Monthly Estimates of Lumber Stocks: Each sample mill also reported lumber stocks on hand at the end of each month. With this information, estimates of total lumber stocks, by species, were prepared for each state and OPA price region. In addition, lumber stocks reports were obtained each month from about one-third of the 466 concentration yards in our region, and with these an estimate of the total amount of lumber at concentration yards was prepared. At the beginning of the year total sawmill and

concentration yard stocks of lumber were 507 million board feet, but by December 31, 1945, they had decreased to 477 million feet.

Factors Affecting Lumber Production: In May 1942, after a few fragmentary reports had been made on the subject, an organized effort was made to collect information on the factors which affected the current production of lumber. The basis for this project was the request by the War Production Board for up-to-date, unbiased information which would influence decisions on labor policies, equipment allocation, ceiling prices, and other matters influencing lumber production. Throughout 1943, 1944, and to V-E Day in 1945 the project was continued and expanded, and reports were prepared for the Appalachian Hardwood and the Coastal Pine regions on a quarterly basis. After V-E Day much of the detailed subject matter was discontinued, and semi-monthly summary reports were prepared up to December 31, 1945. A summary of the relative importance of the various factors affecting production in 1945 is expressed below in percent:

Manpower		Mfg. facilities		Raw Materials		Cost-Price		
Woods Mill		Eqpt.	Plant	Stump- age	Log In- ventory	Weather	Relation- ship	Markets
40	30	12	3	0	5	10	Trace	Trace

Special Reports and Surveys: During 1945 the demand for special investigations and reports decreased. In April we were asked by WPB to investigate and report on production and inventories of poles and piling in 1944 and 1945. This survey revealed that production of treated poles in 1944 was 60 percent greater in 1944 than in 1943, and was expected to be 65 percent greater in 1945. Piling production was 40 percent less in 1944 than in 1943, and in 1945 was expected to be 14 percent less than 1943. On April 1, 1945, pole inventories were 25 percent less and piling inventories 9 percent less than on April 1, 1943.

Early in 1945 the railroads of the nation became alarmed over the reported serious decline in the production of crossties. In order to determine the facts regarding production trends, WPB asked us and other groups in tie-producing territories to find out how much production had declined, and to suggest remedial measures. The resulting investigation showed that 1944 tie purchases were 35 percent below 1943 and that no improvement could be expected under the conditions prevailing in the early part of 1945. Low ceiling prices were found to be the chief retardant to production, a situation that was later corrected by OPA at the suggestion of WPB, with resulting increases in production.

Other activities included the following:

1. Investigation and report on retail lumber stocks and the effect of ceiling prices on the production of dimension versus boards.
2. Preparation of an estimate of woods and plant employment in primary forest industries, by individual industries, for each state in our territory. Data were combined with that from other Stations, and a national report by states was prepared in Washington.
3. Preparation of a report on the logging truck tire situation and tire needs of the logging industry in the Appalachian hardwood and Carolina-Virginia pine regions.

Cooperation with Bureau of Census

Cooperation was continued with the Bureau of the Census in the collection of reports on 1944 lumber production. Including the area covered by TVA, a total of 138 counties were completely canvassed, and reports were obtained from 6,367 mills. With this sample the Bureau of the Census planned to prepare production estimates by regions and states, but to date they have not been published.

Eastern Kentucky Highlands Project

The year 1945 brought to a close our cooperative studies with the University of Kentucky of land-resource management in the Eastern Kentucky Highlands. These studies were made in a sample area within Breathitt, Knott, and Perry Counties, and has as their purpose to learn the present and potential contribution of land resources to the well-being of the people.

The five principal reports resulting from these studies are (1) management of forests in the Quicksand area of the Kentucky Highlands; (2) timber marketing in the Eastern Kentucky Highlands; (3) farm production, labor supply, and family income in the Quicksand area of the Kentucky Highlands; (4) the sociology of land use in the Breathitt area of Eastern Kentucky; and (5) farm and forest resources in the economy of the Eastern Kentucky Highlands. Station personnel contributed authorship in three of these: the first, second, and fifth.

In the course of the main studies data were gathered which were not included in the principal reports. One article on cull from fire has been published and additional articles are in process on fire history and damage, and on forest-management opportunities in Eastern Kentucky. Timber volume and yield tables made as a

part of the regular work are to be published by the Kentucky Experiment Station.

As a result of the work, and on the basis of the research findings, the University of Kentucky has set up a project of extension and demonstration in and around the study area, including work on farm lands as well as assistance in all aspects of timber management and marketing. Some attention is being given to developing small-scale local industry. On the University's nearby Robinson Forest a plan for active management and for timber sales has been made and approved by University authorities. The net result of these activities has been to arouse some local interest in forestry, and to create a much keener interest in forestry at the University. It is believed that these studies offer - as did our cooperative studies in forest grazing - an excellent example of the accomplishments possible by pooling diverse skills and facilities. Although the University of Kentucky furnished by far the major contribution in funds, time, and technical manpower to these comprehensive land-use studies, the Station's contribution of an able forest economist was an invaluable element in orienting and correlating individual aspects and in helping the whole project forward to successful completion.

Forest Influences

During 1945, the work of this small division, reduced at the low ebb to two technicians, continued to be expanded primarily in the maintenance of essential and basic field records and observations on the Bent Creek and Coweeta Experimental Forests and in the preparation of reports covering back work.

One major study brought to completion during the past year was on local climates as affected by the complete or partial removal of vegetation. This is the so-called Copper Basin study involving climatic studies in a region where smelter fumes had completely removed vegetation over a large area surrounded roughly by concentric rings of grass and shrub and then normal upland hardwood forest vegetation. This study substantiates earlier reports showing the marked effect on local climate brought about by the partial or complete removal of vegetation. It puts fresh emphasis on the influence of the presence or absence of leaves in a deciduous forest upon local temperatures and wind movements. The study also indicates the possibility that presence or absence of vegetation over large and continuous areas affects surface heating, and that this in turn may affect precipitation.

Work continued on the major watershed management studies at Coweeta where various types of land use and water utilization by various trees and forest types are being studied in relation to their effects on water storage and stream flow.

Range Investigations 1/

Interest in the possibilities of forest grazing continues at a high level in the Southeast. This is indicated by the fact that during the past year several companies with large forest holdings have started some grazing or have asked questions about grazing management.

Overgrazing forest range was found to be a poor practice in three trials with beef cattle conducted at the Hofmann Forest in Jones and Onslow Counties. Overgrazing caused the cattle gains and length of grazing season to be reduced and the stand of reeds, which furnished the most desirable forage, to be severely injured. Calves produced on lightly grazed areas weighed 350 pounds at weaning time, and were graded "choice," whereas those on closely grazed areas weighed only 275 pounds. Similarly, in the Coastal Plain of Georgia steers kept on closely grazed areas gained only 53 pounds per head during the summer while those on lightly grazed areas gained 78 pounds, and those on moderately grazed areas 67 pounds.

Cattle in the forests apparently have no appreciable adverse effect on pine seedling establishment, and also they do very little damage to young pines. They may have a definite beneficial effect. Clipping studies show that the amount of grass rough on the range is reduced by from one-third to two-thirds by grazing, thus greatly reducing the fire hazard. Other studies indicate that if cattle are going to be used to reduce hardwood competition appreciably, the degree of grazing must be heavy, probably too heavy for the welfare of the cattle. However, it may be possible to graze heavily for 6 to 8 weeks in the spring for this purpose, while the leaves are young and tender, without much loss of weight by the cattle.

Studies in North Carolina show the practicability of wintering breeding cows on forest range in this area. Even though some of the cows were fed as much as 6 pounds of cottonseed meal per head daily, they were wintered more economically than they could have been wintered on the farm at existing food prices. Where the cows were not fed enough supplement and wintered poorly, death losses were excessive and the following calf crops materially reduced.

During the past year an additional field of promising work was undertaken at the Station, namely, a study of the possibilities of improving the range by the introduction of better species of grasses and legumes. One of the fundamental problems in forest grazing in the Southeast, as is well known, lies in the low value of much of the native forage. It is deficient in protein, phosphorous, and calcium during a large part of the year. If suitable grasses or legumes could be discovered or developed and grown on forest ranges to replace some of the native species, it might be possible to change the entire picture with regard to the profitability and character of the livestock

1/ These investigations in cooperation with the Bureau of Animal and Plant Industry and the North Carolina and Georgia Coastal Plain Experiment Stations.

industry. The work now getting under way in this field will be devoted in its initial stages primarily to methods of establishing promising species in field nurseries and establishment plots. Other work will involve a more comprehensive search for promising species and means and methods of practical introduction.

Forest Utilization Service

The year 1945 marked the establishment at the Appalachian Station of a small Forest Utilization Service with the assignment of two senior technicians. This unit, devoted to obtaining better forest utilization in the Station's territory, has already established itself as a valuable liaison between the Station, Forest Products Laboratory, and forest industry, and gives every promise of making an early and worthwhile contribution to forest utilization practice.

Studies begun under the auspices of a similar unit at the Southern Station and taken over by the Appalachian unit include two cooperative studies with companies manufacturing textile machinery or parts, with the objective of finding substitutes for the high quality hickory and dogwood used in picker sticks and shuttles, material now very scarce and expensive. Staypak seems to offer some promise for this purpose, and shuttles and picker sticks of this material furnished by the Forest Products Laboratory were installed in regular commercial looms for tests.

Cooperative research was started with the North Carolina Agricultural Experiment Station on the development of a wood-burning furnace for tobacco curing in an attempt to stimulate the use of low quality wood as fuel and thus improve farm wood lots. A new furnace which would be more economical and more convenient, particularly in lengthening the period between firings, would serve this purpose.

Cooperative work was also undertaken with the North Carolina State College on the construction of a sawdust burning dry kiln. The College plans to use this kiln to demonstrate a small, convenient lumber seasoning installation for use where steam is not available.

Various other studies were carried forward, but as the Utilization unit was installed at this Station only in October, no finished results are available for this calendar year. Next year will be a different story.

Forest Pathology

During the war years the main effort in Forest Pathology (conducted by the Division of Forest Pathology of the Bureau of Plant Industry, Soils and Agricultural Engineering in cooperation with the Forest Service) was devoted primarily to problems in wood aircraft. For example, yellow-poplar veneer and lumber, in heavy demand by the aircraft industry, was variously colored in the living tree, the colored wood commonly making up to 50 percent of the total volume cut from some areas. Much of this material was being rejected on the suspicion of weakness. Strength tests on hundreds of specimens, supplemented by microscopic examination and cultures, established the fact that most of the discolored wood was sound and of normal strength, and that only brown-colored wood need be suspected of decay. It is estimated that this made available the production of about 25 percent more yellow-poplar aircraft veneer at a critical time in the war period.

The Army was also advised, following an extensive study of various types of wood aircraft and gliders in Service, as to how to avoid decay in wood aircraft, this information being funneled directly to the Army fields by the A.A.F. Air Service Command.

Although most of our pathological effort during the war period went into wood aircraft studies, work was continued nevertheless upon various important tree diseases. On one shade tree disease, mimosa wilt, search for resistant lines has produced a few trees, raised from seed, that are now 7 years old and healthy despite having been inoculated three times and grown in infested field soil. Over 700 other seedlings given similar treatment were killed.

Among the forest diseases of the Appalachian region, work has continued on timber decays, the hardwood cankers, and the little leaf disease of pine. In the field of timber decays as related to sprout origin stands, a matter of obvious importance in all cultural operations in upland hardwoods, we now have an excellent basis for establishing sound practices. It has been shown, for example, that among oaks of sprout origin where the incidence of decay from the parent stump is high, that sprouts originating highest on old stumps have the greatest chance of becoming decayed. As these sprouts will usually grow to be the dominant sprouts in a clump, they must be eliminated, usually, before the stands are more than 15 years old. Other work indicates that clump or twin thinning is risky from a decay standpoint if the trees are larger than 3 inches d.b.h., or have V-crotches, but that such thinning is safe even with larger trees if the sprouts are well separated, or with U-crotches. Any kind of oak sprout clump can be thinned with safety from decay if under 15 years of age.

In addition, past work shows that oak wounds should be kept under 1.5 inches in width if the incidence of heart rot from wounds is to be kept under 10 percent, and that wounds larger than 2 to 3 inches remain open for over 5 years and are consequently easily subject to decay. As previously stated, results of this kind are fundamental to designing good cultural practices, and emphasize in this case the importance of age in planning the treatment of oak sprout stands.

Work on the little leaf disease of pine, now established as the major problem in growing shortleaf and in some places loblolly pine over hundreds of thousands of acres throughout the piedmont and the upper coastal plain of Alabama, has uncovered strong clues in the direction of inadequate nitrogen nutrition and the possible role of soil and root fungi. The little leaf belt is one of the lowest in soil nitrogen of any region in the United States. Foliar analyses of little leaf trees show them to be conspicuously low in nitrogen and somewhat low in calcium. Application of nitrogen to the soil tends to prevent little leaf among healthy trees and to induce recovery in diseased trees. Accordingly, although the exact cause of this important disease is still unknown, it begins to look more and more as if it was tied up with nutritional conditions through deficiencies in the functioning of absorbing roots. If this is true, the problem of preventing or ameliorating this disease in the long run may fall upon forest managers and require special management provisions to bring about and maintain the proper environmental conditions necessary for healthy stands. A great deal more work on this point is needed.

Recent pathology research has uncovered a new killing fungus disease of sugar maple called sapstreak, a new *Fusarium* canker on southern pines called pitch canker, and a severe and widespread blighting of the foliage of white pine of unknown cause. Experiments are in progress testing the use of the pitch canker fungus for the stimulation of gum flow in turpentine.

A LOOK AHEAD

It is said that the long continued expansion of the Roman Empire over a period of centuries was essentially a search by military administrators for defensible frontiers, an objective apparently never reached. Perhaps in a similar way no forest research administrator will ever be wholly satisfied with the resources in manpower and money at his command. In all probability there will always be unexplored frontiers of knowledge, or undeveloped work areas lacking adequate attention. In any event, in spite of the fact that the substantial expansion in southern forest research, cited in introductory paragraphs, has given us a much better basis for a broad regional

program of comprehensive scope, the work of this Station is still obviously deficient in its coverage of several important fields. The experimental forest program, as of 1945, in itself obviously needs further development in order to cover adequately even the major physiographic regions and forest types. The Station has no work worthy of the name under way in the field of forest economics, except the fire economics project of temporary character. Our fire studies program has failed to keep pace with a greatly expanded action program in the forest protection field, and obvious improvements can still be made in fire protection. Our Forest Utilization Service, consisting of two technicians only, is obviously inadequate to a region embodying parts of six states, a forest area of some 74 million acres and an overwhelming array of forest products industries. Other important fields such as those of forest grazing and forest influences are being attacked only on an extremely narrow front.

Accordingly, until the station activities in the fields cited can be strengthened and expanded, we will be unable to do the job allotted in adequate fashion. Nevertheless, the substantial postwar expansion now under way puts the Station in perhaps the best position in its history to serve the region properly. It is true that this expansion brings substantial problems in Station reorganization and in the proper conduction of research, one of which is in the training of the research personnel upon whose individual ability the success of the Station's efforts will stand or fall. Now that we are again on a peacetime footing and undertaking new work, it will also be necessary to provide for better planning, inspection, and review of research activities. To this end we intend as early as feasible to enlist the aid of competent technicians, landowners, and forest industrialists in this territory to assure an outside and friendly but critical scrutiny of research work.

In any event, the forest research future now seems to be one bright with promise. We are looking forward confidently to substantial accomplishments during our first year of normal peacetime activity. It is hopeful that the next report, which we intend to prepare on a full scale, will fully justify this optimism.

I. T. Haig, Director

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